* NOTICES *

HAGA TERUBUMI et al.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the drive circuit of a power unit and a power unit, and relates to the drive circuit of the power unit and power unit which can be especially used for the printer of an electrophotography method, a copying machine, etc.
[0002]
[Description of the Prior Art] In the printer of an electrophotography method, a copying machine, etc., the output stability of the high voltage power supply equipment for development affects the homogeneity of image quality concentration. In recent years, the demand to high definition increases and the wide range output control of DC component is needed in the high voltage power supply equipment for development to functions, such as photograph mode by environmental control, the concentration control on a photo conductor, and user setup. Moreover, in the electrification power unit and the imprint power unit, the wide range output control of DC component is needed similarly.
[0003] There is a self-excitation type RCC (ringing choke converter) circuit which was superior to before comparatively simply [circuitry] and in cost as such a power unit. An example of such a self-excitation type RCC circuit is shown in drawing 11 . As shown in drawing 11 , if the starting current flows to the base terminal of a switching transistor 42 through the starting resistance 90 connected between DC power supply 16 and the base terminal of a switching transistor 42, an electrical potential difference is impressed to the primary coil 36, the induced voltage proportional to this electrical potential difference occurs in a bias winding 38, this induced voltage supplies a current to the base terminal of a switching transistor 42 through resistance etc., and a switching transistor 42 turns on a self-excitation type RCC circuit. And if induced voltage is lost, a switching transistor 42 turns off, if all the excitation energy of a transformer 20 is emitted after that, a kick electrical potential difference occurs in the direction which carries out forward bias of the base terminal of a switching transistor 42, and a switching transistor 42 turns on again. Thus, a self-oscillation is carried out and high pressure is generated.
[0004] There is a problem that turn-off actuation becomes unstable by the ringing of a current which flows to the primary coil 36 of a transformer 20 , in such a self-excitation type RCC circuit , in order to combine a separate excitation type RCC circuit and a shunt regulation circuit in order to solve this , or to control a ringing , the capacity between secondary coils is divide , diode is insert or the technique of delay turn-on timing is propose (reference , such as JP,3-57709,B) .
[0005]
[Problem(s) to be Solved by the Invention] However, with the above-mentioned conventional technique, components mark increased and there was a problem that cost became high. In addition, the current by the side of the primary coil 36 in the above-mentioned self-excitation type RCC circuit The rushes current which flows to the so-called distributed capacity by the capacity between the secondary coil 40 sides, and the capacity between primary secondary coils produced between the primary coil 36 and the secondary coil 40, And it consists of composition of the current which flows for the inductance

component (the so-called leakage inductance) of the primary coil 36, and a ringing occurs for this leakage inductance and said distributed capacity resonating.
[0006] Moreover, such a drive circuit of a self-excitation type RCC circuit has the thing equipped with the on-off circuit 92 which consists of resistance, diode, a transistor, etc. while inputting the input voltage (for example, 24V) to a transformer 20 into the base terminal of a switching transistor 42 through a starting resistance 90, as shown in drawing 11 . In such a drive circuit's making the transistor of the on-off circuit 92 turn on by the on-off signal outputted from the main control section 18 at the time of OFF of a power unit, and making it the starting current not flow to a switching transistor 42 and making a power unit turn on, he makes the transistor of the on-off circuit 92 turn off, and is trying for the starting current to flow to the base terminal of a switching transistor 42 through a starting resistance 90.
[0007] Although input power was once turned off and the reclosing of the input power was carried out at the time of a restart when the activity which a paper jam is generated by a printer etc. in such a configuration, and removes a paper to it was done, input voltage fluctuation occurred at this time, and there was a problem that a drive circuit incorrect-operated. Moreover, at the time of OFF of a power unit, since the current flowed to the transistor of the on-off circuit 92, since it was constituted including resistance, diode, a transistor, etc. as mentioned above, it not only consumes useless power, but the on-off circuit 92 had the problem that the miniaturization of a circuit could not be attained while cost became high.
[0008] This invention is accomplished that the above-mentioned problem should be solved, and aims at offering the drive circuit of the power unit which can prevent malfunction at the time of the reclosing of input voltage with the power unit and the easy configuration which can control a ringing with an easy configuration and can stabilize output voltage.
[0009]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the power unit of invention according to claim 1 The transformer equipped with the input coil with which power is inputted into an end, the bias winding to which induction of the power according to the power impressed to this input coil is carried out, and the output winding, A switching means by which a control-input edge switches impression of the power to said input coil according to the power by which was connected with said bias winding and induction was carried out to said bias winding while an end is connected with the other end of said input coil, It connects between the other end of said input coil, and said control-input one end of said bias winding, and is characterized by having a current control means to control the current which flows at said switching means and said control-input edge.
[0010] According to invention according to claim 1, in an output winding and a bias winding, a switching means turns on with the power with which induction of the power according to the power impressed to that of an input coil was carried out, and induction was carried out to the bias winding, and if the power by which induction was carried out is lost, a switching means is turned off. And if all the excitation energy of a transformer is emitted, a kick electrical potential difference occurs in the direction which carries out forward bias of the control-input edge of a switching means, and a switching means turns on again. Thus, a switching means switches the power which carries out a self-oscillation and is impressed to an input coil. A transistor and MOS-FET can be used for this switching means.
[0011] Since the current control means is connected between the other end of said input coil, and said bias winding, the current to the control-input edge at the time of the turn-on of a switching means is controlled. For this reason, the rushes current (rush current) by the distributed capacity by the capacity between output-winding sides and the capacity between input output windings produced between an input coil and an output winding can prevent flowing for a switching means. Therefore, generating of a ringing can be prevented and an output is stabilized. A capacitor can be used for a current control means.

[0012] The transformer by which, as for invention according to claim 2, the power according to the power with which it was impressed by the input coil with which power is inputted into an end, and this input coil was equipped with the bias winding by which induction is carried out, and the output winding,

A switching means by which a control-input edge switches impression of the power to said input coil according to the power by which was connected with said bias winding and induction was carried out to said bias winding while an end is connected with the other end of said input coil, In the drive circuit of said power unit which performs starting of preparation ********** based on an external remote signal, it is characterized by starting said power unit by inputting said external remote signal into the control-input edge of said switching means through resistance at least.

[0013] According to invention according to claim 2, the current by the external remote signal turns into the starting current for being controlled by resistance and starting a power unit. This external remote signal can use for example, an PWM signal. Therefore, malfunction of the drive circuit by the input voltage fluctuation at the time of the reclosing of input power can be prevented like [in the case of inputting the input voltage of several 10 V into a switching means through a starting resistance like before, and starting a power unit]. Moreover, since an on-off circuit becomes unnecessary, and a current does not flow to the transistor of an on-off circuit like before at the time of OFF of a power unit, useless power is not consumed. Moreover, low cost-ization can be attained while being able to miniaturize equipment.

[0014] The transformer by which, as for invention according to claim 3, the power according to the power with which it was impressed by the input coil with which power is inputted into an end, and this input coil was equipped with the bias winding by which induction is carried out, and the output winding, A switching means by which a control-input edge switches impression of the power to said input coil according to the power by which was connected with said bias winding and induction was carried out to said bias winding while an end is connected with the other end of said input coil, An input means to input the external remote signal for starting into the control-input edge of said switching means through resistance at least, It connects between the other end of said input coil, and said control-input one end of said bias winding, and is characterized by having a current control means to control the current which flows at said switching means and said control-input edge.

[0015] Since it had an input means to input into the control-input edge of said switching means at least the current control means and the external remote signal for starting which control the current which flows at a switching means and said control-input edge through resistance according to invention according to claim 3, while being able to prevent generating of a ringing and being able to stabilize an output, malfunction of the drive circuit by input voltage fluctuation can be prevented.

[0016]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail with reference to a drawing. In addition, the gestalt of this operation applies this invention to bias-power-supply equipments for development, such as a copying machine and a printer, the bias-power-supply equipment for an imprint, the bias-power-supply equipment for electrification, etc.

[0017] As shown in drawing 2 , the power unit 10 concerning the gestalt of this operation is equipped with the high voltage power supply section 14 which supplies the high tension power for supplying a load 12, DC power supply 16 which generate predetermined direct current voltage, and the main control section 18 which manages actuation of the whole equipment.

[0018] The high-voltage-power-supply section 14 is equipped with the pressure-up transformer 20, the rectification smoothing circuit 22, a switching circuit 24, the electrical-potential-difference detector 26, the control circuit 28, the D/A conversion circuit 30, and the bootstrap circuit 32.

[0019] The pressure-up transformer 20 consists of a 34 or primary iron core coil 36, a bias winding 38, and a secondary coil 40, as shown in drawing 1 . One terminal of the primary coil 36 is connected to DC power supply 16, the direct current voltage Vin (for example, 24V) generated by these DC power supply 16 is impressed, and induction of the power according to this is carried out to a secondary coil 40 and bias-winding 38 side. Moreover, as for the other-end child of the primary coil 36, the collector terminal of the transistor 42 of a switching circuit 24 and one terminal of a tuning capacitor 44 are connected. Impression of the power to the primary coil 36 is switched by turning this transistor 42 on and off.

[0020] As for one terminal of the secondary coil 40, the cathode terminal of diode 46 is connected, and the other-end child is grounded. As for the anode terminal of diode 46, one terminal of the capacitor 48

by which the other-end child was grounded, and one terminal of resistance 50 and 52 are connected. Rectification smooth [of the current by which induction was carried out to the secondary coil 40 side] is carried out by diode 46 and the capacitor 48, and it is outputted to a load 40 through resistance 52.
[0021] Moreover, as for the other-end child of resistance 50, the input edge of the electrical-potential-difference detector 26 is connected, and the outgoing end of the electrical-potential-difference detector 26 is connected to one input edge of the comparator circuit 54 of a control circuit 28. As shown in drawing 3 as an example, it is constituted including an operational amplifier, resistance, and a capacitor, and the electrical potential difference outputted to a load 12 is detected, and the electrical-potential-difference detector 26 is the voltage monitor value Vmon. It carries out and outputs to a comparator circuit 54.
[0022] On the other hand, one terminal of a bias winding 38 is connected to the anode terminal of the diode 58 by which the other-end child and capacitor 56 of a tuning capacitor 44 were connected to juxtaposition. The other-end child of a bias winding 38 is grounded. The cathode terminal of diode 58 is connected to one terminal of resistance 60, the other-end child of resistance 60 is connected to the base terminal of a transistor 42, and, as for the emitter terminal of a transistor 42, one terminal of resistance 64 by which the capacitor 62 was connected to juxtaposition is connected. The other-end child of resistance 64 is grounded.
[0023] Moreover, as for the base terminal of a transistor 42, the offset voltage power source 66 of a bootstrap circuit 32, one terminal of resistance 68, and the anode terminal of diode 70 are connected. . The offset voltage power source 66 consists of resistance, zener diode, and a capacitor, as shown in drawing 3 as an example. The other-end child of resistance 68 is connected to the cathode terminal of diode 72, and the anode terminal of diode 72 is connected to the outgoing end of the electrical-potential-difference level-conversion circuit 74. The input edge of the electrical-potential-difference level-conversion circuit 74 is connected to the outgoing end of the main control section 18.
[0024] The main control section 18 consists of microcomputers to which CPU, ROM, RAM, an I/O (I/O) circuit, etc. were respectively connected by bus. The input edge of the D/A conversion circuit 30 is also connected to the outgoing end of this main control section 18, and the PWM signal according to the electrical potential difference which should be supplied to a load 12 is outputted to it. For example, output voltage will become low if the output voltage to a load 12 will become high if the duty value of this PWM signal becomes large, and a duty value becomes small.
[0025] Moreover, after an PWM signal is outputted also to the electrical-potential-difference level-conversion circuit 74 and is changed into a predetermined voltage level in the electrical-potential-difference level-conversion circuit 74, it is inputted into the base terminal of a transistor 42 as the starting current through diode 72 and resistance 68. Moreover, as for the electrical potential difference inputted into the base terminal of a transistor 42, the electrical potential difference below a predetermined electrical potential difference (for example, 2.5V) is offset by the offset voltage power source 66 for stabilization. In addition, the electrical-potential-difference level-conversion circuit 74 is unnecessary depending on the voltage level of an PWM signal. Moreover, the electrical-potential-difference level-conversion circuit 74 and the D/A conversion circuit 30 are constituted including a transistor, resistance, and a capacitor, as shown in drawing 3 as an example.
[0026] The outgoing end of the D/A conversion circuit 30 is connected to the input edge of another side of a comparator circuit 54. The D/A conversion circuit 30 carries out D/A conversion of the PWM signal outputted from the main control section 18, and outputs it to a comparator circuit 54 as an analog signal (target electrical-potential-difference value). The comparator circuit 54 is connected with the electrical-potential-difference detector 26 while the base terminal of a transistor 76 is connected. Moreover, the emitter terminal of a transistor 76 is grounded and, as for the collector terminal, the cathode terminal of diode 70 is connected. A comparator circuit 54 is the voltage monitor value Vmon which is constituted including an operational amplifier, a capacitor, and resistance, and is outputted from the electrical-potential-difference detector 26 as shown in drawing 3 as an example. The target electrical-potential-difference value outputted from the D/A conversion circuit 30 is compared, turning on and off of a transistor 76 is controlled, and the base current of a transistor 42 is controlled so that the output voltage

to a load 12 carries out abbreviation coincidence with a target electrical potential difference.
[0027] Next, the operation in the gestalt of this operation is explained.
[0028] If an PWM signal as shown in drawing 4 (A) is outputted by the main control section 18, a voltage level will be transformed into a predetermined electrical potential difference by the electrical-potential-difference level-conversion circuit 74, and the starting current will flow to the base terminal of a transistor 42 through diode 72 and resistance 68. The output voltage Va (electrical potential difference outputted to a points in drawing 3) of the electrical-potential-difference level-conversion circuit 74 at this time, the electrical potential difference Vb (electrical potential difference outputted to b points in drawing 3) impressed to the base terminal of a transistor 42, and base current Ib A wave turns into a wave as shown in drawing 4 (B), (C), and (D), respectively. In addition, electrical potential difference Vb impressed to the base terminal of a transistor 42 Predetermined electrical-potential-difference (for example, 2.5V) offset is carried out.
[0029] Collector current IC of the transistor 42 as shown in drawing 4 (E) according to this starting current It flows and an electrical potential difference is impressed to the primary coil 36. And induced voltage VX proportional to the electrical potential difference impressed to the primary coil 36 as shown in drawing 5 (E) It generates in a bias winding 38.
[0030] Induced voltage VX generated in the bias winding 38 In order to supply a current to the base terminal of a transistor 42 further through resistance 60 and to make base current increase, a transistor 42 will be in an ON state and a "on" period starts.
[0031] Since the rushes current IX (part in [a] drawing) by distributed capacity as shown in drawing 5 (D) flows to a tuning capacitor 44 at the time of this turn-on, Base current Ib of a transistor 42 It is controlled and can fully control that the ringing of a collector current IC like before shown in drawing 12 (B) occurs. Change of the ringing amplitude can be suppressed to change of output voltage for a load 12 to the minimum, and turn-on actuation can be stabilized. In addition, drawing 12 (A) and (C) are the collector to emitter voltage Vce and base current Ib of a transistor 42 in the former. It is shown, respectively.
[0032] The current which flows to the primary coil 36 in a "on" period, i.e., collector current IC of a transistor 42, Although it increases almost linearly and a transformer 20 is excited, carrying out a ringing, it is base current Ib. It is controlled by resistance 60 and decreases gradually. (Therefore, the current which flows to an input coil, i.e., collector current IC, It is saturated with the value expressed with the following (1) type, and is the induced voltage VX of a bias winding 38. It is lost, and a transistor 42 will be in an OFF state and a "off" period starts.)
[0033] IC =HfexIb ... (1)
However, Hfe is the current amplification factor of a transistor 42.
[0034] It is base current Ib by the current IX (part in [b] drawing) which flows to a tuning capacitor 44 at the time of this turn-off. Since supply interruption can be performed gently-sloping, it can prevent surge voltage occurring in the collector to emitter voltage Vce of a transistor 42 like before shown in drawing 12 (A). For this reason, a noise is reduced and output voltage can be stabilized. Moreover, the electrical-potential-difference stress to a transistor 42 or the component of transformer 20 grade is mitigated.
[0035] At a "off" period, it is the induced voltage VX of a bias winding 38. In order to carry out the reverse bias of the base terminal of a transistor 42 to a negative electrical potential difference, a "off" period is maintained until the excitation energy of a transformer 20 is emitted to a load 12 side from the secondary coil 34.
[0036] If all the excitation energy of a transformer 20 is emitted to a load 12 side, it is the induced voltage VX of a bias winding 38 rapidly. Although it disappears, a ringing occurs in the direction which carries out forward bias of the base terminal of a transistor 42 by the leakage inductance and distributed capacity of a transformer 20, and a transistor 42 is again made into an ON state. Thus, on-off control action is repeated and a transistor 42 continues an oscillation. Thereby, it is the high pressure of several kV. (for example, 1kV) A load 12 is supplied. In addition, when the electrical-potential-difference value supplied to a load 12 is higher than a target electrical-potential-difference value, a comparator circuit 54

draws the base current which turns on a transistor 76 and flows to a transistor 42. Thereby, the electrical-potential-difference value supplied to a load 12 is maintained at a target electrical-potential-difference value. Moreover, in suspending high-pressure supply for a load 12, it carries out by setting to 0 the duty value of the PWM signal outputted from the main control section 18.

[0037] Thus, with a tuning capacitor 44, since the actuation at the time of a turn-on and a turn-off is stabilized and output voltage can be stabilized, charge supply of development, an imprint, electrification, etc. is stabilized, and the homogeneity of image quality concentration can be maintained. Moreover, the circuit for the Snubber energy control at the time of the turn-off which was the need conventionally becomes unnecessary, and equipment can be miniaturized.

[0038] Moreover, since the on-off judgment circuit is unnecessary while being able to prevent malfunction of the bootstrap circuit at the time of a power-source reclosing like before in order to start a transistor 42 with the PWM signal which carried out the electrical-potential-difference level conversion, it can miniaturize and equipment can be low-cost-ized.

[0039] Next, other examples of a power unit 10 are explained with reference to drawing 6 thru/or drawing 8 . In addition, the same sign is given to the same part as the power unit 10 of drawing 1 , and the detailed explanation is omitted.

[0040] The power unit 10 shown in drawing 6 is the same as the power unit 10 shown in drawing 1 except having replaced with the transistor 42 shown in drawing 1 , and having considered as MOS-FET42.

[0041] Moreover, as for the power unit 10 shown in drawing 7 , one terminal of tuning capacitors 44A and 44B is connected to the other-end child of the primary coil 36. As for one terminal of tuning capacitor 44A, the anode terminal of diode 80 is connected, and, as for the cathode terminal of diode 80, one terminal of a bias winding 38 is connected. As for one terminal of capacitor 44B, the cathode terminal of diode 82 is connected, and, as for the anode terminal of diode 82, one terminal of a bias winding 38 is connected. It is the same as that of the power unit 10 shown in drawing 1 except this.

[0042] One terminal of a tuning capacitor 44 is connected to the other-end child of the primary coil 36, and, as for the power unit 10 shown in drawing 8 , one terminal of resistance 84 is connected to the other-end child of a tuning capacitor 44. As for the other-end child of resistance 84, one terminal of a bias winding 38 is connected. It is the same as that of the power unit 10 shown in drawing 1 except this. The almost same actuation as the power unit 10 which also shows the power unit shown in such drawing 6 thru/or drawing 8 to drawing 1 is carried out.

[0043] Next, other examples of the bootstrap circuit 32 of a power unit 10 are explained with reference to drawing 9 and drawing 10 . In addition, the same sign is given to the same part as the bootstrap circuit 32 of drawing 1 , and the detailed explanation is omitted.

[0044] The bootstrap circuit 32 shown in drawing 9 is the same as that of the bootstrap circuit 32 shown in drawing 1 except for a point without the offset voltage power source 66 and diode 72. The bootstrap circuit 32 shown in drawing 10 is the same as that of the bootstrap circuit 32 shown in drawing 1 except for a point without diode 72. The almost same actuation as the bootstrap circuit 32 which also shows the bootstrap circuit 32 shown in such drawing 9 and drawing 10 to drawing 1 is carried out.

[0045] In addition, although the gestalt of this operation explained the power unit 10 applied to the self-excitation RCC circuit combining the tuning capacitor 44 and the bootstrap circuit 32 which used the external remote signal, you may apply independently not only in this, respectively. Moreover, although the gestalt of this operation explained the power unit made to generate the high pressure of several kV, it cannot be overemphasized that this invention can be applied not only to this but to the power unit which outputs an about [number 10V- number 100V] electrical potential difference.

[0046]

[Effect of the Invention] Since a current control means to control the current which flows at the control-input edge of a switching means and a switching means was established between the other end of an input coil, and a bias winding according to invention according to claim 1 as explained above Since the rushes current by the distributed capacity by the capacity between output-winding sides and the capacity between input output windings produced between an input coil and an output winding can be controlled,

generating of a ringing can be prevented, and it has the effectiveness that output voltage is stabilized.
[0047] Since it becomes the starting current for the current by the external remote signal being controlled by resistance, and starting a power unit according to invention according to claim 2, while being able to prevent malfunction of the drive circuit by the input voltage fluctuation at the time of an input power reclosing, since an on-off circuit becomes unnecessary, equipment can be miniaturized, and it has the effectiveness that low cost-ization can be attained.
[0048] Since it had an input means inputted into the control-input edge of said switching means at least the current control means and the external remote signal for starting which control the current which flows at a switching means and said control-input edge through resistance according to invention according to claim 3, while being able to prevent generating of a ringing and being able to stabilize an output, it has the effectiveness that malfunction of the drive circuit by input-voltage fluctuation can prevent.

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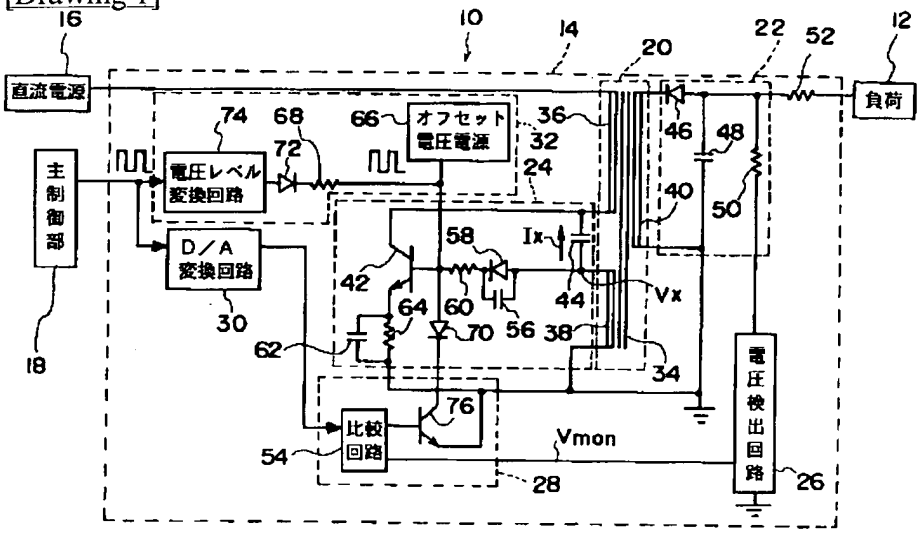
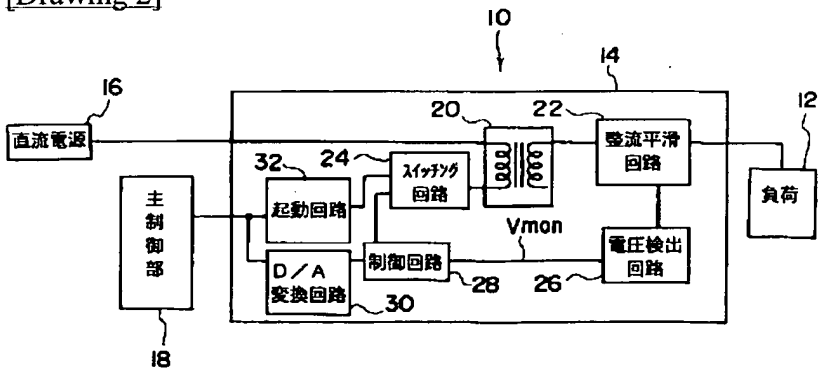
DRAWINGS

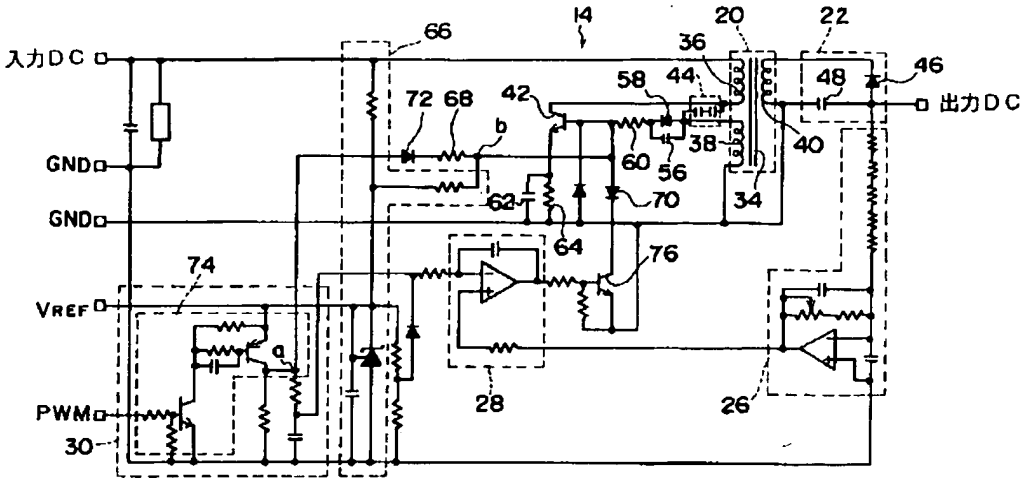
[Drawing 1]



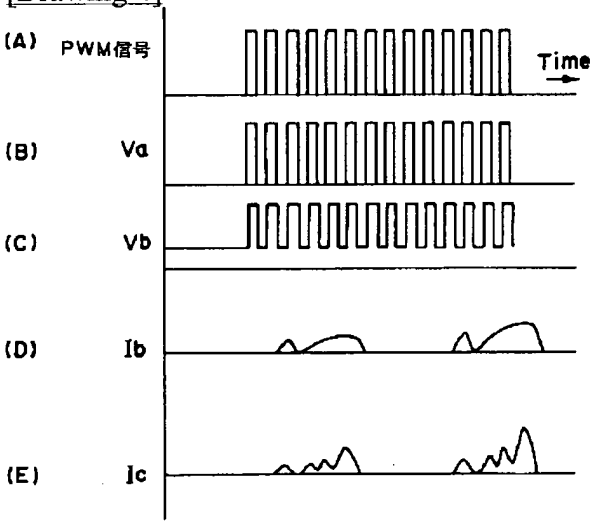
[Drawing 2]



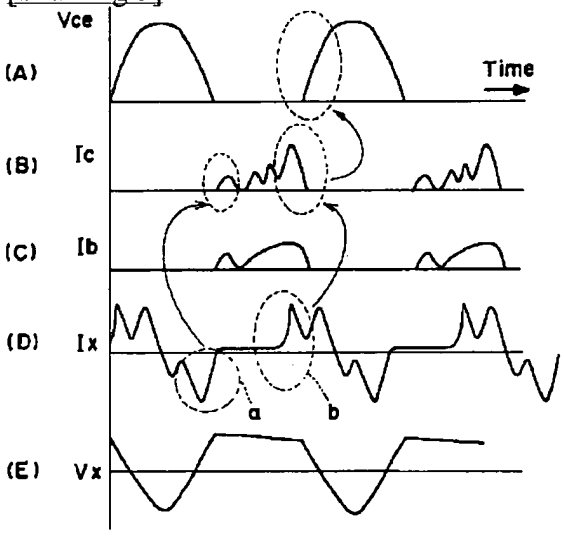
[Drawing 3]



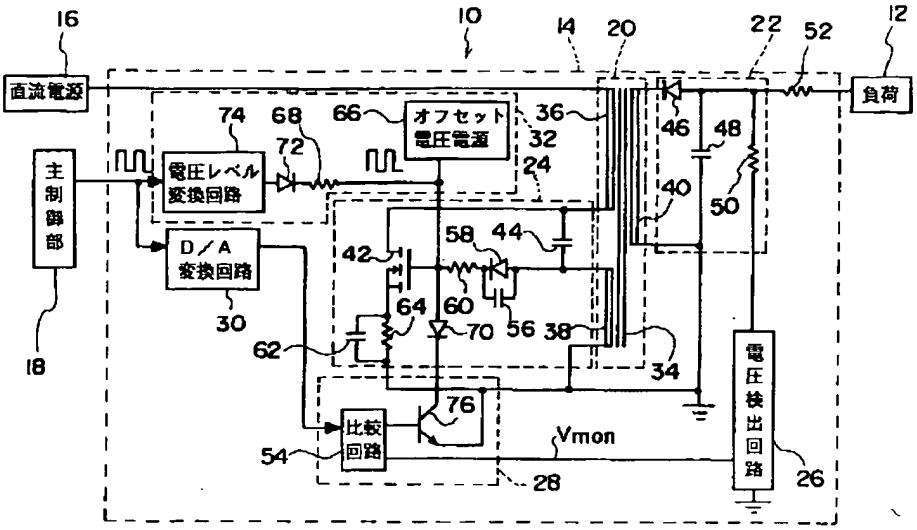
[Drawing 4]



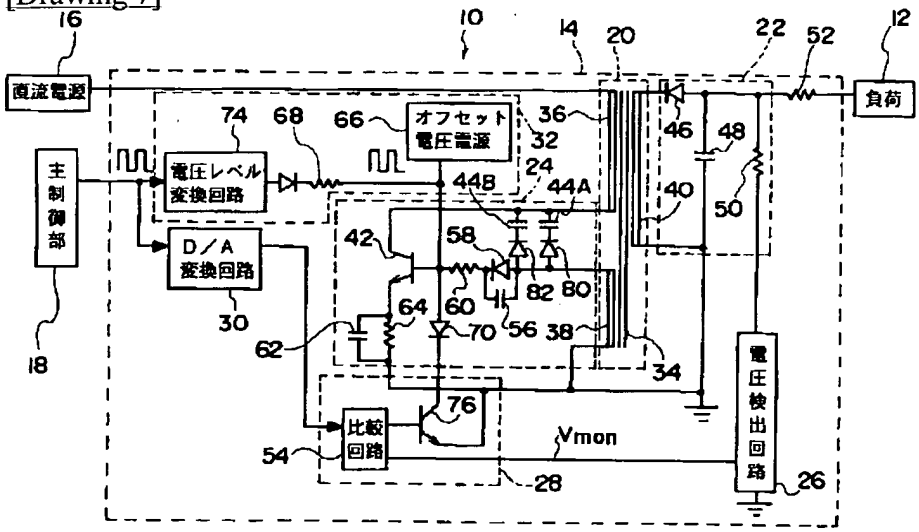
[Drawing 5]



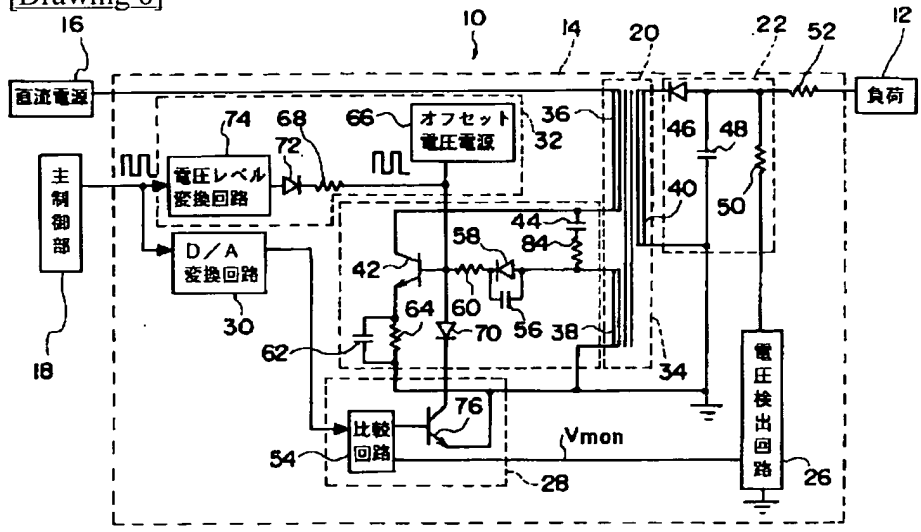
[Drawing 6]



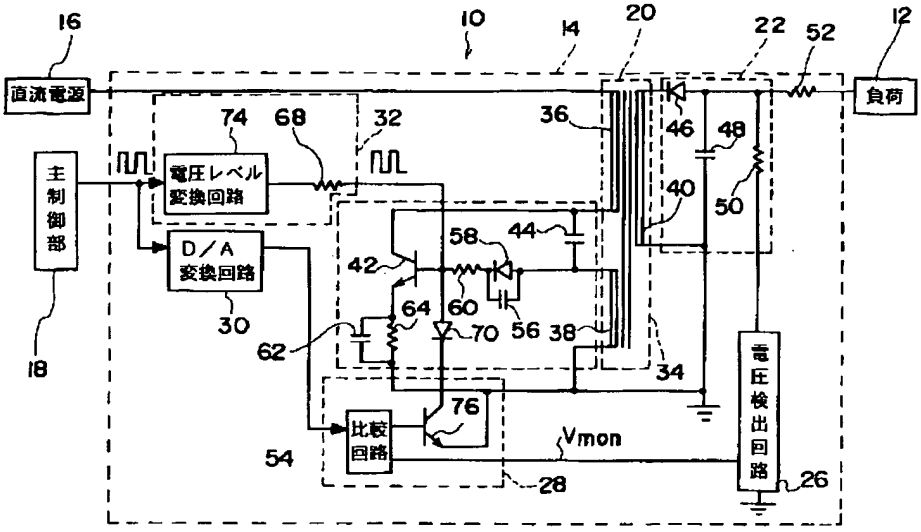
[Drawing 7]



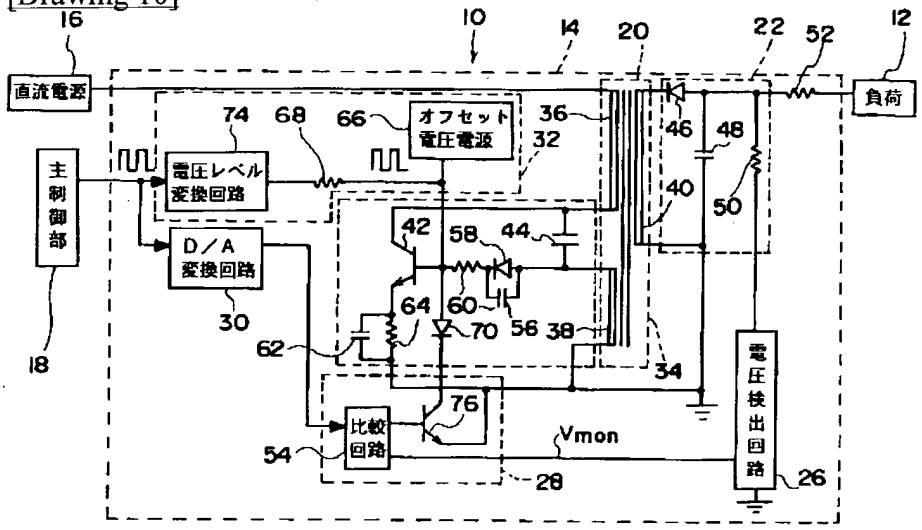
[Drawing 8]



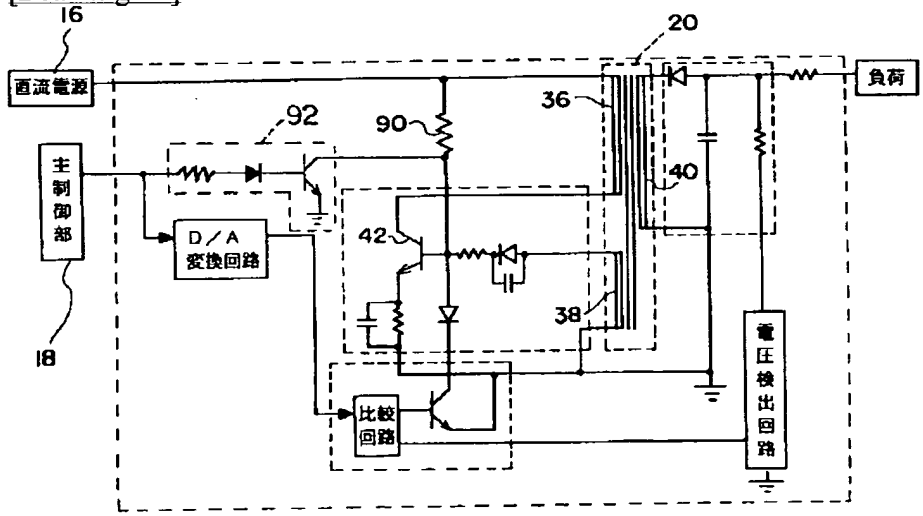
[Drawing 9]



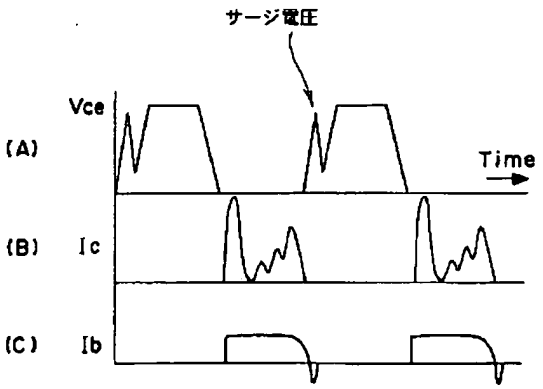
[Drawing 10]



[Drawing 11]



[Drawing 12]



[Translation done.]